WHAT IS CLAIMED IS:

1.   A method of analyzing a multidimensional system comprising the steps of:

acquiring a plurality of signals, each signal representing a corresponding

5   channel that is associated with a different spatial location of the multidimensional

system;

generating a phase space representation for each channel as a function of

the corresponding one of the plurality of signals;

generating a signal profile for each phase space representation, each signal

10   profile reflecting a rate of divergence of the corresponding phase space

representation;

for a selected predictor, chosen from amongst a number of possible

predictors, deriving a signal profile for one or more critical channel groups, each

signal profile reflecting a level of correlation between the channels of each critical

15   channel group; and

characterizing the state dynamics of the multidimensional system as a

function of the signal profile associated with at least one critical channel group.

2.   The method of claim 1 further comprising the step of comparing each

20   signal profile associated with a critical channel group to a threshold value, wherein

said step of characterizing the state dynamics of the multidimensional system is

based on the result of the comparison.

3.   The method of claim 1 further comprising the step of:

25   comparing each signal profile associated with a critical channel group to a

disentrainment threshold value and an entrainment threshold value, wherein said

step of characterizing the state dynamics of the multidimensional system is based

on the result of the comparison.

30   4.   The method of claim 3 further comprising the steps of:

determining whether each signal profile associated with a critical channel group exceeded the disentrainment threshold value; and

determining whether each signal profile associated with a critical channel group drops below the entrainment threshold value.

5

5.   The method of claim 4, wherein at least one of said entrainment threshold and said disentrainment threshold is an adaptive parameter.

6.   The method of claim 1 further comprising the steps of:

10   detecting a system event indicative of non-chaotic system behavior;

for each of a plurality of predictors, deriving a signal profile for each channel groups, each signal profile reflecting a level of correlation between the channels of each channel group; and

for each of the plurality of predictors, identifying a number of critical

15   channel groups.

7.   The method of claim 6 further comprising the step of:

choosing the selected predictor from amongst the plurality of predictors as a function of the signal profiles reflecting level of correlation for the critical

20   channel groups associated with each predictor.

8.   The method of claim 6 further comprising the step of:

after each of a number of system events, updating the number of critical channel groups of each predictor.

25

9.   The method of claim 8 further comprising the step of:

choosing the selected predictor from amongst the plurality of predictors as a function of the signal profiles reflecting level of correlation for the critical channel groups associated with each predictor.

30

10.   The method of claim 6, wherein said step of identifying the number of critical channel groups for each predictor is based on the signal values in a limited portion of the level of correlation signal profile associated with each channel group of each predictor, preceding the system event.

11.   The method of claim 10, wherein said step of identifying the number of critical channel groups for each predictor is based on the signal values in a limited portion of the level of correlation signal profile associated with each channel group of each predictor, subsequent to the system event.

12.   A method of providing seizure warnings comprising the steps of:

        acquiring a plurality of time-series signals, each signal associated with a different location of the brain, and where each signal and its corresponding location constitute a corresponding channel;

        generating a spatio-temporal response for each channel as a function of a corresponding one of the time-series signals;

        generating a signal profile for each spatio-temporal response, each signal profile comprising a sequence of chaoticity values reflecting a rate of divergence of the corresponding spatio-temporal response;

        detecting at least one seizure-related event;

        after each at least one seizure-related event, determining, for each of a plurality of predictors, a level of entrainment associated with each channel group for each predictor, and based on the level of entrainment associated with each channel group, determining a number of critical channel groups for each predictor;

        choosing a selected predictor from amongst the plurality of predictors based on the level of entrainment of the critical channel groups associated with each predictor;

        determining when the level of entrainment associated with one or more of the critical channel groups of the selected predictor is statistically significant; and

        generating a seizure warning when it is determined that the level of

entrainment associated with at least one critical channel group of the selected

predictor is statistically significant.

13.   The method of claim 12, wherein said step of generating a signal profile

for each spatio-temporal response involves generating a sequence of Lyapunov

exponent values for each spatio-temporal response.

14.   The method of claim 13, wherein the Lyapunov exponent values are short-

term Lyapunov exponent values.

15.   The method of claim 12, wherein said step of determining, for each of the

plurality of predictors, the level of entrainment associated with each channel group

is based on the level of entrainment within a time window, the majority of which

precedes the at least one seizure-related event, where the at least one seizure-

related event is an entrainment transition event.

16.   The method of claim 12, wherein said step of determining, for each of the

plurality of predictors, the level of entrainment associated with each channel group

is based on the level of entrainment within a first time window preceding the at

least one seizure-related event and a second time window subsequent to the at least

one seizure-related event, where the at least one seizure-related event is a seizure.

17.   The method of claim 12, wherein said step of determining, for each of the

plurality of predictors, the level of entrainment associated with each channel group

comprises the step of:

        generating a sequence of T-index values for each channel group.

18.   The method of claim 12, wherein said step of choosing the selected

predictor from amongst the plurality of predictors comprises the step of:

                comparing the level of entrainment associated with the critical channel

groups of each of the plurality of the predictors.

19.   The method of claim 18, wherein the selected predictor has critical channel groups that exhibit relatively high levels of entrainment prior to seizures as compared to the critical channel groups associated with other predictors.

20.   The method of claim 19, wherein the selected predictor has critical channel groups that exhibit disentrainment following seizures as compared to the critical channel groups associated with other predictors.

21.   The method of claim 12, wherein the selected predictor has critical channel groups that exhibit relatively high levels of entrainment during entrainment transition events as compared to the critical channel groups associated with other predictors.

22.   The method of claim 12, wherein the selected predictor has critical channel groups that exhibit relatively high levels of entrainment prior seizures and entrainment transition events, and relatively disentrainment following seizures.

23.   The method of claim 12, wherein said step of determining when the level of entrainment associated with one or more of the critical channel groups of the selected predictor is statistically significant comprises the step of:
        comparing the level of entrainment associated with each critical channel group of the selected predictor to at least one threshold value.

24.   The method of claim 23, wherein said step of comparing the level of entrainment associated with each critical channel group of the selected predictor to at least one threshold value comprises the step of:
        comparing the level of entrainment associated with each critical channel group of the selected predictor to an entrainment threshold value.

25. The method of claim 24, wherein said step of comparing the level of entrainment associated with each critical channel group of the selected predictor to at least one threshold value further comprises the step of:

comparing the level of entrainment associated with each critical channel group of the selected predictor to a disentrainment threshold value, and wherein a determination that the level of entrainment associated with one or more of the critical channel groups of the selected predictor is statistically significant involves a determination that the level of entrainment has exceeded the disentrainment threshold value and subsequent thereto dropped below the entrainment threshold.

26. The method of claim 12 further comprising the step of:

generating a seizure prediction when it is determined that the level of entrainment associated with at least one critical channel group of the selected predictor is statistically significant.

27. The method of claim 12 further comprising the step of:

updating each critical channel group of the selected predictor after each subsequent seizure-related event.

28. The method of claim 27, wherein said step of updating each critical channel group of the selected predictor comprises the step of:

reselecting one or more critical channel groups for the selected predictor as a function of the level of entrainment, associated with each channel group of the selected predictor, within a time window, the majority of which precede the seizure-related event, where the seizure-related event is an entrainment transition event.

29. The method of claim 27, wherein said step of updating each critical channel group of the selected predictor comprises the step of:

reselecting one or more critical channel groups for the selected predictor as a function of the level of entrainment, associated with each channel group of the selected predictor, within a first time window preceding the seizure-related event and a second time window following the seizure-related event, where the seizure-

5   related event is a seizure.

30.   A method of providing seizure warnings comprising the steps of:
        choosing a selected predictor from amongst a plurality of predictors;
        acquiring a plurality of time-series signals, each signal associated with a
10   different location of the brain, and where each signal and its corresponding location constitute a corresponding channel;
        generating a spatio-temporal response for each channel as a function of a corresponding one of the time-series signals;
        generating a signal profile for each spatio-temporal response, each signal
15   profile comprising a sequence of chaoticity values reflecting a rate of divergence of the corresponding spatio-temporal response;
        determining whether the level of entrainment associated with one or more critical channel groups of the selected predictor is statistically significant; and
        generating a seizure warning if it is determined that the level of
20   entrainment associated with one or more critical channel groups of the selected predictor is statistically significant.

31.   The method of claim 30, wherein said step of determining whether the level of entrainment associated with one or more critical channel groups of the
25   selected predictor is statistically significant comprises the step of:
        comparing the level of entrainment associated with each of the one or more critical channel groups of the selected predictor to at least one threshold value.

32.   The method of claim 31, wherein said step of comparing the level of
30   entrainment associated with each of the one or more critical channel groups of the

selected predictor to at least one threshold value comprises the step of:

comparing the level of entrainment associated with each of the one or more critical channel groups of the selected predictor to an entrainment threshold value.

5   33.   The method of claim 32, wherein said step of comparing the level of entrainment associated with each of the one or more critical channel groups of the selected predictor to at least one threshold value further comprises the step of:

comparing the level of entrainment associated with each of the one or more critical channel groups of the selected predictor to a disentrainment threshold

10   value, and wherein a determination that the level of entrainment associated with one or more of the critical channel groups of the selected predictor is statistically significant involves a determination that the level of entrainment has exceeded the disentrainment threshold value and subsequent thereto dropped below the entrainment threshold.

15

34.   The method of claim 30 further comprising the step of:

generating a seizure prediction when it is determined that the level of entrainment associated with one or more critical channel groups of the selected predictor is statistically significant.

20

35.   The method of claim 30 further comprising the step of:

updating the one or more critical channel groups of the selected predictor after each seizure-related event.

25   36.   The method of claim 35, wherein said step of updating the one or more critical channel groups of the selected predictor comprises the step of:

reselecting the one or more critical channel groups of the selected predictor as a function of the level of entrainment, associated with each channel group of the selected predictor, within a time window, the majority of which precedes the

30   seizure-related event, where the seizure-related event is an entrainment transition

event.

37.   The method of claim 35, wherein said step of updating the one or more

critical channel groups of the selected predictor comprises the step of:

5   reselecting the one or more critical channel groups of the selected predictor

as a function of the level of entrainment, associated with each channel group of the

selected predictor, within a first time window preceding the seizure-related event

and a second time window following the seizure-related event, where the seizure-

related event is a seizure.

10

38.   An apparatus providing seizure interdiction comprising:

        a plurality of sensors, each configured for acquiring a time-series signal

associated with a corresponding location of a patient's brain;

        processing means for generating a seizure warning based on the time-series

15   signals, said processing means comprising,

                means for receiving the time-series signals; wherein each time-

series signal along with the corresponding location of the patient's brain

constitutes a separate channel;

                means for generating a phase space representation for each channel

20   as a function of the corresponding one of the plurality of signals;

                means for generating a signal profile for each phase space

representation, each signal profile reflecting a rate of divergence of the

corresponding phase space representation;

                means for deriving a signal profile for each of a number of critical

25   channel groups associated with a selected predictor, chosen from amongst a

number of predictors, each signal profile reflecting a level of entrainment among

the channels of each critical channel group;

                means for determining whether a level of entrainment associated

with one or more critical channel groups of the selected predictor is statistically

30   significant;

means for generating a seizure warning if it is determined that the level of entrainment associated with one or more critical channel groups of the selected predictor is statistically significant; and

a seizure interdiction device coupled to said processing means, said seizure

5   interdiction device comprising means for delivering antiseizure treatment to the patient if a seizure warning signal is generated.

39.   The apparatus of claim 38, wherein said processing means further comprises:

10   means for updating the one or more critical channel groups for the selected predictor after each of a number of seizure-related events.

40.   The apparatus of claim 39, wherein said means for updating the one or more critical channel groups comprises:

15   means for reselecting the one or more critical channel groups of the selected predictor as a function of the level of entrainment, associated with each channel group of the selected predictor, within a time window, the majority of which precedes the seizure-related event, where the seizure-related event is an entrainment transition event.

20

41.   The method of claim 39, wherein said means for updating the one or more critical channel groups comprises:

means for reselecting the one or mor critical channel groups of the selected predictor as a function of the level of entrainment, associated with each channel

25   group of the selected predictor, within a first time window preceding the seizure-related event and a second time window following the seizure-related event, where the seizure-related event is a seizure.